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(54) SECURITY SYSTEM

(71) We, AMERICAN DISTRICT TELEGRAPH COMPANY, a Corporation organised under the laws of the State of New Jersey, United States of America, 591 Summit Avenue, Jersey City, New Jersey 07306, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

There are presently available electronic devices which monitor and detect and feedback information to a master control. There are also systems available which require various techniques for entrance to any area. For instance, doors can only be opened by the insertion of a special key in the form of a card which is supposedly being used by a particular person. These systems operate by means of various detecting devices such as electric photocells, frequency variation of sound and heat. However, none of these systems offers absolute security both in terms of the allowable person and also the controlled entry times.

Illegal entry and theft constitute a major financial loss all over the word and are becoming a greater menace each day. This problem is not being solved due to a lack of proper surveillance and detection devices and equipment. In particular, this problem is most severe wherever there is a great movement of personnel or a large number of transient personnel. This problem immediately focusses on hotels, motels, schools, convention centers, etc.

The present invention provides a security system which controls entry of personnel into a restricted area and can control the time of entry.

Advantages attendent preferred forms of the present invention are the elimination of the expensive lock and key replacements which are required with conventional locking systems. operability as surveillance means to monitor various conditions in the area and provision of a disposable coded key with an unlimited number of combinations.

In accordance with the present invention there is provided a security system for controlling entrance to an area including a lockable barrier at the entrance to the area, an area keyport, actuating means between said area keyport and said lockable barrier, a master console disposed remote from said area keyport, said master console having a plurality of individual master keyports, a coded key for insertion into said area and master keyports, scanning means between said area keyport and said master console for cyclically scanning said keyports and initiating said actuating means for inactivating said lockable barrier to permit entrance to the area when said area keyport and one of said master keyports have identical coded keys inserted therein.

Also in accordance with present invention there is provided a method of controlling admittance to an area having a lockable barrier comprising inserting a coded card into a keyport in a master console having a plurality of such keyports, sequentially feeding data from the keyports of the master console to a comparator during individual time phases, comparing the data from each phase with data fed from an area keyport adjacent the locked barrier, and inactivating the locked barrier when there is matching data fed from the area keyport by insertion of a coded card identical to the card in the master console keyport.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an elevation view schematically illustrating a security system incorporated in a motel in accordance with a preferred embodiment of this invention;

Figure 2 is a block diagram schematically illustrating the electrical connections between the various components in a monitor station and a master control station;

Figures 3 and 3A are wiring diagrams schematically illustrating the principle of

operation of the security system illustrated in Figure 1;

Figure 4 is a block diagram schematically illustrating the manner in which coded keys are formed;

Figure 5 is a front elevation view of a key forming device;

Figure 6 is a cross-sectional view taken through Fig. 5 along the line 6—6;

Figure 7 is a plan view showing a coded key inserted in a keyport;

Figure 8 is a cross-sectional view taken through Figure 7 along the line 8—8;

Figures 9a—9d are plan views of alternative forms of coded keys;

Figure 10 is a cross-sectional plan view of a prior art lock;

Figure 11 is a cross-sectional elevation view of a prior art lock taken through Figure 10 along the line 11—11;

Figure 12 is a cross-sectional plan view of a preferred locking arrangement;

Figures 13—14 are cross-sectional elevation views of the locking arrangement shown in Figure 12 in different phases of operation;

Figure 15 is a cross-sectional view taken through Figure 14 along the line 15—15;

Figures 16—17 are views similar to Figures 13—14 of an alternative locking arrangement;

Figure 18 is a schematic view in elevation of the security system which includes a further alternative locking arrangement;

Figure 19 is an elevation view of the locking arrangement of Figure 18;

Figure 20 is a cross-sectional view taken through Figure 19 along the line 20—20;

Figure 21 is a front elevation view of the locking arrangement shown in Figure 19;

Figure 22 is an elevation view of the locking arrangement shown in Figures 19—21 in a different phase of operation;

Figures 23—24 are cross-sectional views taken through Figure 22 along the lines 23—23 and 24—24, respectively;

Figure 25 is a cross-sectional plan view similar to Figures 20 and 23 in a different phase of operation;

Figure 26 is a plan view partly in section showing a still further phase of operation;

Figure 27 is a cross-sectional view in elevation of an alternative locking arrangement;

Figures 28—29 are cross-sectional views taken through Figure 27 along the lines 28—28 and 29—29, respectively;

Figure 30 is a cross-sectional view similar to Figure 27 showing the locking arrangement illustrated therein in a different phase of operation;

Figure 31 is a cross-sectional view taken through Figure 30 along the line 31—31;

Figure 32 is a cross-sectional view similar to Figures 27 and 30 showing the locking arrangement in a different phase of operation; and

Figures 33—34 are cross-sectional views taken through Figure 32 along the lines 33—33 and 34—34, respectively.

Figure 1 illustrates a security system 10 in use in a motel. Obviously this invention may equally be applied to other environments such as hotels, schools, convention centers, etc. As indicated in Figure 1 each guest room 12 is generally considered a restricted area having a locked barrier in the form of a door 14 for preventing unauthorized entrance to the room. Adjacent door 14 is an area keyport 16. Each area keyport sensor 16 may be considered as located in a monitor station. Figure 1 also illustrates a central location or office 18 which includes a master console having a plurality of keyport sensors duplicating the monitoring station keyport sensors hereafter called console guest keyport sensors, plus console master keyport sensors as required for authorized persons other than guests. Also located at this master control station is a key manufacturing device 22.

In general when a guest registers at office 18 a set of coded keys is made by device 22 and one key 24 is given to the guest. The other key is inserted in the proper console guest keyport corresponding to the guest's room. Thereafter when the guest inserts his coded key 24 into keyport 16, as later described a comparison device detects the presence of matched coded keys in keyport 16 and at master console 20 which unlocks door 14 to permit the guest to enter his room 12. As also later described entry into the room is prevented unless there are a pair of such matching keys in the area keyport 16 and at the master console 20. Thus if a key is lost or if a new guest checks into the room, a new set of keys is made and one key of the new set replaces the former key in the master console to prevent entry by means of the former guest key. As also later described master console 20 includes a guest keyport corresponding to the number of doors plus a plurality of master keyports, each master keyport having the capability of accepting a correctly coded key which will release a plurality of doors so that other authorized personnel such as a maid or maintenance man may enter the room when such other personnel inserts a key into keyport 16 which matches the appropriate key in a master keyport in master console 20.

As indicated in Figure 3, the data from keyport 16 is transmitted to data comparing station 56 wherein a comparison is made with one of the keyports of the master console 20. In this respect scanning means in the form of a station address indicator 42, and phase address indicator 42A are provided whereby a plurality of individual keyports in the master console may be sequentially compared with the station keyport 16. Thus as schematically illustrated in Figure 3 during a single address time of station address indicator 42 a plur-

ality of phases sequentially occur. For example in one phase a comparison would be made of the guest keyport 36 with station keyport 16 and in subsequent phases of the same address time keyport 16 would be compared with keyports 38, 40 and 44 respectively. It is to be understood that keyport 44 represents any number of master keyports in accordance with the desired results. If data comparing station 56 indicates that matching coded keys are in keyport 16 and one of the programmed console keyports, this information is transmitted to lock 30 thus permitting the lock to open. The general arrangement also includes an alarm 46 which is actuated on master console 20 when, for example, data comparing station 56 detects an improper key in keyport 16 which does not match any of the authorized keys for keyports 36, 38, 40 and 44. Similarly, through use of common wiring the master console includes a signal 50 by the maid to indicate, for example, when the room is ready for occupancy. Signal 50 would be actuated by a maid closing switch 48 in or around the guest's room. The signal or light would remain on until switch 49 at the master console is actuated. Any number of such signals may be used in accordance with the desired results.

As is readily apparent countless conditions might be sensed with this arrangement, such as whether or not air-conditioning or other equipment is properly operating. The increased surveillance function might, however, increase the time period for one cycle.

Figure 3 is referred to for further detailed description. As indicated therein the data from keyport 16 is transmitted through cable 60A to data comparing 56 when station 16 is addressed via the station address indicator 42 and conductor 35A. For example, cable 60A consists of a given number of conductors such as 23 in accordance with the needs of the system. The conductors are each attached to particular inputs of the data comparing 56 which is a multi-input exclusive OR gate which has as many inputs as required. Each conductor is compared as to a presence or absence of a voltage on each conductor and any set of conditions is called the data thereon. The station address indicator 42 also addresses the corresponding console guest keyport 36 through phase generator 42A at the same instant. This address causes data from console guest keyport 36 to be transmitted through cable 60 (similar to cable 60A) to particular inputs of the data comparing 56. The respective addressing conductors in the console are indicated as 35, 35_1, 35_n, 37, 39, 43 and 45, and to the keyports they are 35A, $35A_1$ and $35A_n$. Conductor 45 is illustrated in Figure 3 to indicate that a portion of the cycle is devoted to detecting tampering or malfunctioning. The multiplexer switch 41 which may be an absolute switch of the commutator type or a mechanical commutator or its electrical equivalent sequentially moves from one position to another defining the station address time interval. Further, switches 41A, $41A_1$ through to switch $41A_n$ may be absolute switches of the commutator type or mechanical commutators or their electrical equivalent. They are ganged together such as being mounted on a common shaft so that they all seqeuentially progress in unison. Their rate is one complete cycle per station address time. The time each switch rests in one position is a phase time for purposes of discussion, and there are as many phases as required by the system. The phase time is the minimum time of key code comparison or data transmission. Typically, the phase time is 1/1000 second, which could vary depending on the system constraints.

If each of the corresponding data input lines from the console guest keyport 36 and the keyport 16 correspond, a signal is transmitted along line or cable 62 to release lock 30. Switch SS_0 is closed for this operation via address signal on conductor 35A, switches SS_1 through SS_n are closed sequentially via respective address signals on cable 35A through $35A_n$. If the data do not compare, phase indicator 42A sequentially moves to the next phase wherein, as illustrated, data from keyport 16 is compared to that of the maid keyport 38. If the data compares, lock 30 releases, if not, the phase indicator 42A sequentially moves to the next phase wherein, as illustrated, data from keyport 16 is compared to that of the maintenance keyport 40. This sequencing continues until all possible phases have been compared. The last of the phases is reserved to compare for a "no-key" condition in keyport 16. During the "no-key" comparison phase, switch S_1 is opened to disallow lock 30 from releasing if there is a comparison, and S_2 closes to allow a no-comparison signal to traverse to the guest console keyports. The operation is as follows:

If there has been no previous comparison on any compare phases of the address time as determined by the data compare station, and if there is no comparison on this tamper phase, a signal is emitted on the "no compare signal line" (62A). This signal indicates a malfunction or tampering concerning keyport 16. Since S_2 is closed via conductor 45 the signal traverses to all guest console keyports, but only alarm 46 is initiated because only guest console keyport 36 is addressed. After the last phase of keyport 16 has been examined, the station address generator 42 sequentially moves to the next keyport 16_1 and the phase sequence is repeated for that keyport. 16_1 data is transmitted to data compare 56 only when keyport 16_1 is addressed by station address indicator 42. At the same time 42 addresses its corresponding console guest keyport 36_1. During the first phase time period of this address,

keyport 16_1 data and console guest keyport 36_1 data are compared. During the second phase, keyport 16_1 and the maid keyport data, then the maintenance keyport data, etc.

While each console guest keyport will correspond to only one monitoring station keyport, this invention allows a particular keyport to concurrently correspond to one or more console master keyports. An example system configuration is illustrated in Figure 3A. The example therein demonstrates that one keyport may respond when any one of several correct keys are inserted into the keyport. Further, the example shows a possible grouping arrangement. As indicated therein 32 station keyports 16 are provided for 32 individual rooms R_1, R_2, . . . R_{32}. The master console 20 contains 32 individual guest keyports 36 each corresponding to a particular station keyport. The master console is also provided with four maid keyports 38, two maintenance keyports 40 and one overall master keyport 44. (In Figure 3 keyport 44 schematically represents any arbitrary keyports). Thus the maid keyports correspond to groups of 32 rooms, each maintenance keyport corresponds to sixteen different rooms, and the single overall master keyport is provided for all rooms. In a practical example, consider room R_{27}. If a key corresponding to the key in console guest keyport 36_{27} is inserted into the station keyport, the door will unlock. Insertion of a key corresponding to the key in maid keyport M_3 will open the door, insertion of a key corresponding to the key in maintenance keyport Mt_2 will open the door, and finally in this example, a key corresponding to the key in master keyport 44 will open the door. This invention is not intended to be limited by the number of keyports, console guest keyports, maid keyports, or any type or number of master keyports. Further, the phase order in which data comparisons are made or grouped, or method of addressing keyports and/or console keyports and/or other master keyports specifically described herein to explain the concepts are not intended to limit the invention.

In addition to directing the unlocking of various doors in the system, the station address indication 42 in conjunction with the phase indicator 42A need not necessarily keycode data comparison on each phase multiplex. Other important auxiliary data may be transmitted from the room to the master console during some phases such as room ready information or room temperature above or below given limits. This type of information could be detected during a keycode comparison phase with the addition of more wires in the interconnecting cable. Thus, since a multitude of data might cause the number of phases required to become large thus causing the system cycle time to become very long, additional data is transmitted concurrently during keycode compare phase. A desirable total system surveillance time is less than two seconds.

The order of phasing described above is not intended to limit this invention. The system's flexibility allows any order of phasing to yield desired results. For instance, it may be desirable to compare the keyport data to the "no-key" condition first; if a comparison is obtained, and all necessary auxiliary data is obtained during this first phase, skip the other phases and update station address indicator to the next keyport. This will reduce system cycle time. If there is a no-comparison, something is in the keyport—thus the other phases will be scanned. If a comparison is reached during any keycode phase, the remainder of the phases are skipped.

Operating in this manner allows an automatic generation of a tamper signal, i.e. utilizing the last phase as a tamper or malfunction detection phase, it will only be reached if no valid comparison has been reached on the other phases of the address time. As stated before, if a valid comparison was reached on an earlier phase, the remaining phases including the tamper or malfunction detection phase are skipped.

Figure 2 schematically illustrates in still further detail the interrelationship between the components at a monitor station 26 and at master control station 18. It is to be understood that a different monitor station would be provided for every room in conjunction with a corresponding console guest keyport in a master control station located at a central location. As indicated in Figure 2 an area keyport 16 is provided with a slot 28 for receiving a coded key such as from a guest or other authorized personnel. Insertion of a coded key into slot 28 initiates a signal which generates a stimulus such as pressure, heat or light to create electrical conduction. Monitor station 26 through its electronic components is capable of sending signals back to a receiving station or control station for instructions based upon the detected signal and can receive signals from a master control and respond by initiating appropriate action. For example as illustrated in the various embodiments of this invention, monitor station 26 has either mechanically or either electrically connected to it means for operating a door latch 30 to permit entry into a restricted area such as room 12.

The system 10 is in continuous operation and station addressed signals are received continually in the station address receiver and decoder 32. The decoder 32 recognizes the particular station key opening slot or port 28 and puts out a gate signal into data gate 34. The gate signal is further segmented into phases and each phase can be addressed individually within the gate time. Thus when the station is addressed the control console devotes its attention to that particular station and in particular to that particular phase.

Each phase is in a preprogrammed time period which is used to interrogate until all stimuli have been examined. As also illustrated in Figure 2 master console 20 includes console guest keyports 36 corresponding to each door plus console master keyports 38, 40 which allows specific authorized personnel other than guest to enter any one of a plurality of rooms. There is only one console master keyport for each auxiliary function or person, i.e. housekeeper or maintenance engineer. Thus, for example, keyport 36 may correspond to the guest keyport. Keyport 38 may correspond to the maid's keyport and keyport 40 may correspond to a maintenance man's keyport. Obviously as previously noted any number of keyports may be provided although only three are shown for illustrative purposes.

In the embodiment shown in Figure 2 if a key is inserted in slot 28 the data traverses common cable 52 to data gate 34 and thence through cable 54 to key code data compare station 56. In the meantime as previously described station address indicator 42 through receiver and decoder 58 sequentially selects an appropriate keyport from console 20 which sends its data through cable 60 to key code data comparing 56 for a comparison with the data sent through cable 54. If the data is correct the input data returns through cable 62 into data gate 64 and through cable 66 back to data gate 34 and then through cable 68 to decoder and driver 70 for actuating lock 30. As schematically illustrated in Figure 2 the actuation is accomplished by means of solenoid 72 whereby the authorized personnel may enter room 12.

If the data received in comparing station 56 does not match such as when an incorrect key is inserted in keyport 16, no activation of solenoid 72 results. Advantageously, as noted above the key recognition is a multi-phase operation to conserve on the number of wires in cable A rather than being a single phase. As also previously indicated if a foreign key or illegal entry is attempted this is sensed at comparing station 56 which results in an alarm 46 being indicated at the master console. The same result occurs if there is a break in any of the wires since this would cause an abnormal comparison to be made at station 56.

It is to be understood that this invention is not limited to the above described order of interrogation and also that the invention may be practiced by surveillance examination of two or more stimuli during any one or more phases. The simultaneous transmission of stimuli data would merely require additional wiring to accommodate a plurality of stimuli data being carried at the same time.

As shown in Figure 2 station adress and timing indicator 42 produces a sequentially varying signal which can be detected at any one time as being of definite digital value. Generator 42 generates, for example, a series of a predetermined number of events from which a like number of distinct selections can be made as it recycles continuously or may be indefinitely interrupted as desired. Typically generator 42 recycles continuously and its output feeds cable 74 and inputs multi-address receiver and decoder 58. An alternative arrangement would be to allow indicator 42 to operate in two modes, at a high rate and at a low rate. The particular mode would be selected depending upon whether or not a key is sensed in the guest key comparison phase. This would require that a minimum of the tamper sensing phase be interrupted. If no key is in slot 28 all other phases would be skipped. Thus a signal from the key code comparing station 56 would hasten the system to the next station. If, however, a key is present in keyport 28 all phases may be examined.

As also illustrated in Figure 2, system 10 includes surveillance means for accomplishing any predetermined operation in conjunction with station address indicator 42. In this respect indicator 42 would devote a segment or phase of its cycle to compare the predetermined condition at comparing station 56 which in turn would send a signal through cable 62 into data gate 64 and then through cable 76 into stimulus responder 78 from stimulus responder 78 the data would be transmitted through cable 80 to any suitable performance functioning means 82 when there is a matched comparison sent by stimulus sensor 84 through encoder 86 into comparing station 56.

Although any suitable equipment may be used, the following exemplifies such equipment as listed in the 1971 *Allied Electronics Industrial Catalogue*. Multiaddress receiver and decoder 58 may be one or more SN74154N 4 line to 16 line Decoder/Multiplexer (p. 50). The station address indicator 42 may be 9266966 capacitor (p. 168), resistors (p. 117), 2N3704 transistors (p. 31) and diodes similar to IN270 (p. 17) and a number of SN7473N Dual J/K Flip-Flops. The data compare station may incorporate a series of SN7486N Quad 2 input Exclusive OR Gates (p. 50) and SN151802N 8 input Expandable NAND Gate (p. 2). The data gates 34 may be buffer gates SN15836N (p. 52), SN15858N Quad 2 input NAND gate (p. 52) and MC840P Hex Inverter (p. 60). Stimulus responder 78 may also include SN15858 power gate (p. 52) and SN7475N Quad Bistable Latch (p. 50). Data gates 34 and stimulus encoder 86 may be diodes matrix consisting of diodes similar to 1N645 (p. 17) and SN151810N Quad 2 input NOR gates (p. 52). Station address receiver and decoder 32 may be the same as receiver and decoder 58 but spread out in substations. Data decoder and drive 70 may consist of transistors similar to 2N697 (p. 27) and SN15849N Quad input NAND-NOR Gates (p. 52). It is to be understood that this equip-

ment is merely exemplary and is not intended to limit the invention.

In an advantageous form of this invention the coded keys are suitable cards which may be made of a disposable material so that new sets can be conveniently made when for example one of the cards is lost or when a guest checks into a hotel or motel. Figure 4 schematically illustrates an arrangement 22 for manufacturing the coded cards. As indicated therein a random noise generator 88 is provided which generates noise in a random manner to high speed binary counter 90 and is stopped at any arbitrary time to position a random arrangement of punch drivers 92 for actuating punches 94 which form a random arrangement of holes in a card. The arbitrary stopping of the random noise generator and the actuation of the punches may be controlled through station 96. In an exemplary form of this invention noise generator 88 may be commerically available 2,000 ohm RC20 stock no. 962C 1800 such as listed in the 1971 *Allied Electronics Industrial Catalogue*. Similarly, a suitable counter 90 may be a commercially available SN15809 dual JK Flip-Flop as listed on page 52 of the 1971 *Allied Electronic Industrial Catalogue*.

Figures 5—6 illustrate a mechanism for the arrangement 22 for coding the keys. As indicated therein a shaft 98 is provided with a suitable number of cams 100. Disposed adjacent the cams are a corresponding number of pivotally mounted solenoid housings 101, each having a solenoid 102. In accordance with the random arrangement transmitted from counter 90 a like random arrangement of solenoids is extended to a position between its respective cam 100 and a respective punch 104. Each punch 104 is mounted in channel shaped housing 103 and urged upward by spring 105. The prime mover 106 which would be actuated by control 96 would then cause shaft 98 and its cams to rotate. This rotational movement may simply be imparted by the rotational movement of a crank arm. As each cam rotates certain of the cams will contact its solenoid 102 to cause its punch 104 to be depressed thereby punching a hole into a plastic card 108 arrangeed on a suitable platform 110. If a solenoid is not present the cam will continue to rotate without actuating any punch. In this manner a random arrangement of punched holes is created in card 108 in accordance with the random noise from generator 88. Although Figure 6 illustrate only one card 108 to be present, two or more cards would be inserted on platform 110 so that a plurality of cards are simultaneously made. When a guest checks-in, one or more of the cards would be given to the guest and one card would be retained by the clerk. The clerk would then remove the card which had been in the console guest keyport slot 36 so that the new card could then be inserted therein. As previously described a guest would then be able to enter his room by insertion of his card into keyport slot 28 by a match being detected at comparing station 56.

Any suitable material such as plastic, steel or ceramic, etc., may be used for cards 108 with the primary determinations being the cost factor and the specific method of coding that is utilized. Similarly, instead of forming the key with a card having a line of random openings, the key may take other forms. Figure 9a illustrates one form of key 112 wherein the coding is achieved by openings 114 randomly arranged throughout the card. Figure 9b illustrates a key 116 formed by randomly arranged notches 118 at one edge thereof. Figure 9c illustrates the coding on key 120 to be accomplished by randomly arranged step configurations 122. Figure 9d illustrates the coding on card 124 to be provided by randomly arranged tabs 126. As is readily apparent the number of code variations on any key is unlimited. In practical applications this would vary from 8 million to 16 trillion. Thus is it assured that the possibility of non-simultaneous duplication of any key is virtually eliminated.

Any suitable code detection means may be used in the keyports, such as magnetic sensors which detect magnetic materials within the key, photo sensors which detect holes or reflecting material within the key or mechanical pins locating themselves within the key holes. Figures 7—8 illustrate one form of code detection which is particularly suitable with this invention. As indicated therein the keyport is provided with a plurality of pairs of electrically conductive spring fingers 128 arranged over a width generally corresponding to the width of coded card 108. One set of spring fingers 128a is stamped from a common conductive spring material which may be grounded, while the other set of fingers 128b is embedded in a dielectric chip 132 from which suitable electrical connections 134 are taken. As is readily apparent from Figures 7—8 where openings 136 have been punched into card 108 the pairs of fingers 128a and 128b contact each other to make an electrical connection. Where the card is solid, however, the pairs of fingers are insulated from each other so that no electrical connection is made. Thus a set voltage is created in accordance with the coding of card 108. When identical cards are present in an area keyport 16 adjacent room 12 and in a corresponding keyport in the master console 20, the match is detected or sensed at comparison station 56 and the door to room 12 may be opened. It is particularly noteworthy that the same keyport 16 may be utilized for selectively receiving different cards from any number of different authorized personnel which would result in the opening of door 14 as long as a corresponding keyport is provided on master con-

sole 20 to receive a card which is a duplicate of the particular card used by the authorized personnel.

Electrical contact need not be made continuously. Another method of achieving the desired results would be to have a body containing a plurality of insulated finger-like protrusions (such as switches, Model E63—Cherry Electrical Products, Inc.) which upon depression by the inserted card causes electrical contact to be made within the body.

In accordance with a further preferred embodiment of this invention a novel locking system is used which is particularly adaptable for inclusion in system 10. For a better understanding of this locking arrangement reference is made to Figures 10 and 11 which illustrate a conventional prior art arrangement. As indicated therein the conventional lock includes a lock bolt 138 and a night latch 140. As indicated in Fig. 11 the strike plate 142 has an opening 144 which is shaped in such a manner as to prevent the night latch 140 from moving past the strike plate on the door jamb 146. With such conventional arrangements the retracted night latch 140 prevents lock bolt 138 from being retracted by means other than turning of the door knobs (i.e. prevents retraction of the lock bolt by an external force such as a knife blade). This mechanism has nothing to do with the locking of the door either by an exterior door knob key or an interior doorknob button or twist lock.

Figs. 12—15 illustrate an improved locking arrangement in accordance with a preferred embodiment of this invention. As illustrated in Fig. 15 strike plate 148 includes an opening 150 shaped to permit both the lock bolt 152 and night latch 154 to pass therethrough. With this arrangement lock bolt 152 and night latch 154 are suitably interconnected so that the lock will unlock only when the night latch is extended. This might be accomplished in any suitable manner such as by removing a small section of the bolt in a conventional Schlage or Russwin (Registered Trade Mark) type lock referred to hereinafter. Means are also provided to maintain the night latch retracted for preventing opening of the door. As shown in Fig. 13 the means include a metal latch block 156 which abuts against night latch 154 to hold it in a retracted position. Latch block 156 includes a shoulder 158 for receiving the end of locking level 160 pivoted at 162. A leaf spring 164 is provided to urge the locking lever 160 against latch block 156. The resilient force of spring 164 is overcome by energization of electromagnet 166 so that, as illustrated in Fig. 14, lever 160 is pivoted away from latch block 156. Night latch 154 is spring loaded and is thereby able to be extended pushing aside the latch block 156 whereupon the door may be opened.

In operation when the door is in a closed position with the night latch retracted as illustrated in Fig. 13, the outside doorknob may be either locked in a fixed position or may be free wheeling. Upon insertion of a proper key card into the keyport, electromagnet 166 is energized moving the various latch components to the position illustrated in Figure 14 wherein night latch 154 is extended due to spring pressure within the lock set. If the doorknob 153 is of the fixed position type it would be disengaged and could be turned by the user. Conversely, if the doorknob 153 is of the free wheeling type it would become engaged and could be turned by the user. In either case the turning of the doorknob by the user would allow both the bolt 152 and night latch 154 to be retracted and the door would be opened. Upon retraction of the bolt and night latch, latch block 156 falls back into place such as under the influence of gravity. Since the key would also be removed from the keyport, electromagnet 166 becomes deenergized and locking pivot 160 returns to the position indicated in Figure 13 urged by leaf spring 164. Thus when the door is shut the normally locked condition of Fig. 13 is again established. Should the key be retracted before the door is opened the mechanism would remain in an unlocked condition until the lock bolt and night latch are retracted.

The arrangement shown in Figs. 12—15 is particularly designed as a safeguard against tampering. For example the latch block 156 is maintained in its locking position under the action of its locking pivot 160. Since both the latch block and locking pivot are in a housing 157 in door jamb 161, there would be no way for unauthorized personnel to release the locking pivot from the outside short of cutting a hole through the wall. Conversely, the locking pivot would be quickly released by insertion of the proper key in the keyport.

To effect opening the door from the inside, a mechanically linked activating button 167 could be provided on the internal wall to release the locking pivot 160. In this respect as illustrated in Fig. 12 lever 160 may pivot with shaft 162 which terminates in a non-circular socket 169 exposed at the internal wall 171. Button 167 is in the form of a key having a mating non-circular shank 173 which mates with socket 169. To open the door all the user need do is rotate button or key 167 which in turn causes shaft 162 to pivot lever 160 out of engagement with latch 156 to the position indicated in Fig. 14.

The means described for opening the door from the inside is not intended to limit this invention. A push button technique is quite obvious; and indeed, the lock set itself can be constructed in such a manner that the internal doorknob is turned to open the door.

A practical lock set to operate with housing 157 will perform as follows:

1. Auxiliary latch extended (door open)
   a. Inside and outside knob free to retract latch bolt.
2. Auxiliary latch retracted (door closed, latch bolt dead-locked)
   a. Inside knob free to retract latch bolt.
   b. Outside knob rigid or free wheeling not connected in any way to latch bolt).
      1. Upon extension of latch bolt condition 1. a becomes effective.

Figures 16—17 illustrate an alternative form of locking arrangement. The arrangement illustrated therein is quite similar to that shown in Figs. 12—15 but is particularly advantageous where a narrow door jamb presents space problems. In this respect instead of having the electromagnet 166 to the side of locking lever 160 as illustrated in Figs. 13—14 the electromagnet 166 is disposed above locking lever 160 with a pivoted angle shaped actuating member 168 therebetween. Arm 170 includes a projection 174 which acts as a stop for lever 160 in the condition illustrated in Fig. 16 while arm 172 reacts against lever 160 in the condition illustrated in Fig. 17. As illustrated in Fig. 16 when there is no key in the keyport electromagnet 166 is de-energized and leaf spring 164 reacting against stop 174 maintains locking lever 160 in contact with latch block 156. Upon energization of electromagnet 166, however, actuating member 168 is pivoted clockwise and arm 172 reacts against lever 160 to release latch block 156 whereupon night latch 154 is extended.

The Fig. 16—17 arrangement would also include a mechanical unlatching arrangement such as shown in Fig. 12.

Although Figures 12—15 and 16—17 show particularly advantageous locking arrangements it is to be understood that less sophisticated arrangements might be used. Thus as schematically illustrated in Figs. 2 and 3 insertion of the proper card in the keyports might simply cause extension of a solenoid 72 against bolt 76 to permit the door to open.

Another method of opening the door is to use an electromagnetically operated strike plate. Thes type devices are commercially available and allows the use of the standard lock sets, examples being in commercially available locks sold under the trade names "Schlage" and "Russwin" (Registered Trade Mark).

Other variations are also possible within the scope of this invention. For example, the master console may include only two keyports. One keyport would be used exclusively for holding a card which is the duplicate of the guest's key, while the other or auxiliary keyport would selectively hold the maid's key, maintenance man's key, etc.).

As is apparent from the foregoing description system 10 thus effectively controls not only the personnel who may enter a restricted area, but also the time of entry in addition to providing a means for instantaneously changing the lock combinations.

As illustrated in Fig. 18 a further alternative locking arrangement is provided which is particularly adaptable for incorporation in a security system 200 which is similar to that previously described. As indicated above, system 200 includes a locked barrier or room 202 having a door 204, with an area keyport 206 provided adjacent door 204. The locking arrangement 210 is provided in the door jamb of door 204. At a remote location, such as a hotel or motel lobby, a master console 212 is provided and includes individual keyport 214 each of which corresponds to a particular room. Coded keys in the form, for example, of cards 216 are also included in the system. Thus as previously indicated duplicate cards are made whereby one of the cards would be inserted in the appropriate master console keyport 214 and the guest would retain the other card for insertion in area keyport 206. Scanning means 208 perform a number of functions including detecting when the duplicate cards are in the area keyport and its corresponding master console keyport so as to electronically actuate the locking arrangement 210.

Figs. 19—26 illustrate the various components of locking arrangement 210. As indicated therein the components are disposed in housing 218 in the door jamb 220 adjacent door 204. Door 204 is of suitable construction and includes a latch bolt 222 which is resiliently urged outward so that its flat shoulder 224 abuts against the flat shoulder 246 of strike latch 228. Latch bolt 222 also includes a camming surface 226 as later described. In operation a user would insert his key or card in the area keyport and then push forward against door 204 by utilizing, for example, the external handle 230 as convenient gripping means. The forward pushing force would cause strike latch 228 to pivot thereby permitting the door to open. In practice it has been found that a burst of energy typically 1/20 of a second or more at typically 24 volts is applied to release strike latch 228 from its locking condition and as the door bolt clears the strike latch, the strike latch 228 then returns to its locking condition by means of latch spring 236 so that there is an automatic resetting until a further burst of electrical energy.

The locking arrangement is advantageously a modified version of a known Trine Model 007 Electric Strike. The modifications thereto and the concepts upon which such modifications are based can be applied to other types of units. These modifications include the

omission of the conventional electro-magnets and their mounting and the utilization of electronically actuated mechanical puller means.

Figs. 19—20 illustrate the locking arrangement 210 in its locked condition. As indicated therein strike latch 228 is mounted for pivotal movement about pin 234. Strike latch 228 is urged into this locking position by means of spring 236. A pair of latch stops 238, 240 are also provided with each latch stop including a recess 242 for accommodating pins 244 on the strike latch 228. Accordingly, pivotal movement of the strike latch causes the latch stops to also pivot about their pivot points 246. Conversely, when the latch stops are restrained from pivoting, the strike latch is also prevented from its pivotal movement whereby the strike latch is maintained in its locking position. For this purpose each latch stop includes a notch 248 for engagement with corresponding notches 250 on flap 252. Flap 252 is urged in the path of movement of the latch stops by leaf spring 232.

In order to release the flap 252 from its locking condition electronic means in the form of solenoid 254 is provided which receives a burst of electrical energy to extend its plunger 256 against extension 258 of swivel bracket 260 which, in turn, pivots about pin 262. The opposite end 264 of swivel bracket 260 is inserted through aligned apertures in flap holder 266 and puller arm 268. Puller arm 268 includes an offset extension 270 which engages the frontal face of flap 252. Flap holder 266 includes an undercut 272 which mates with undercut or shoulder 248A of latch stop 238 when the device is in its locking condition. Flap holder 266 also includes a frontal face 274 as later described. A channel shaped guide bracket 276 is provided having arms 278 which provide convenient guide surfaces for the flap holder and puller arm and also provide a stationary member against which leaf spring 232 may react. The flap holder 266 and puller arm 268 together constitute flap actuation means.

As illustrated in Figs. 22—23 upon energization of solenoid 254 swivel bracket 260 is pivoted and its motion is transmitted to both puller arm 268 and flap holder 266 to pull both of these members in a rearward direction. Because of offset 270, flap 252 is also pivoted away from strike plate 228 whereby the strike plate is in a condition to be unlocked. While in this condition front face 274 of flap holder 266 abuts against end face 280 of latch stop 238 thus preventing flap 252 from returning to its locked condition. The components remain in this condition until the user pushes against the door whereby strike latch 228 is pivoted along with latch stops 238, 240. The pivoting movement of latch stop 238 moves the latch stop from abutment against flap holder 266 and the flap 252 automatically returns to its locking condition under the influence of spring 232 as illustrated for example in Fig. 25. Strike plate 228 then also returns to its locking condition by the urging of its spring 236. Upon this return movement the latch stops are also returned to their original condition whereby the remote end of latch stop 238 becomes secured by flap 252. Spring 282 is provided to urge the forward end of flap holder 266 downward.

Advantageously the various components of the locking arrangement are mounted in a housing 218 which includes a removable cover 286 to expose the components therein. Housing 284 also includes a removable end plate 288 upon which solenoid 282 is mounted for ready replacement of the solenoid.

As previously indicated this invention can be conveniently applied to many conventional locking arrangements by suitable modifications thereof. For example, the arrangement illustrated in Figures 19—26 is a modified version of a known Trine Model 007 Electric Strike, while Figures 27—34 illustrate a modified version of the known Trine 002 Electric Strike.

The arrangement illustrated in Figures 27—34 operates along the same general principles as those previously described but differs in detail. Thus the locking arrangement 210A has its components disposed in housing 300 in the door jamb 220A adjacent door 204A. Door 204A includes its latch bolt 222A with its flat shoulder 224A for abutting against the flat shoulder 302 of strike latch 304. Latch bolt 222A also includes ramp surface 226A. The operation of locking arrangement 210A is similar to that previously described wherein the insertion of a proper key causes release of strike latch 304 and subsequent return of strike latch 304 to its locking condition by means of latch spring 306 so that there is an automatic resetting until a further burst of electrical energy.

Figures 27—29 illustrate locking arrangement 210A in its locked condition. As indicated therein strike latch 304 is mounted about pin 308. A single latch stop 310 is provided and includes a recess 312 for accommodating pin 314 on strike latch 304 with pin 314 riding in arcuate slot 315 to control or limit the path of movement of latch 304. Accordingly, pivotal movement of the strike latch causes the latch stop to pivot about its pivot point 316. Conversely, when the latch stop 310 is restrained from pivotting, strike latch 304 is also prevented from its pivotal movement whereby the strike latch is mounted in its locking position. For this purpose flap 318 is movable into the path of motion of latch stop 310 and flap 318 includes a recess 320 for accommodating offset extension 322 of latch stop 310. Flap 318

is urged in the path of movement 310 by leaf spring 324.

In order to release flap 318 from its locking condition electronic means in the form of solenoid 326 is provided which receives a burst of electrical energy to extend its plunger 328 against the bridging face 330 of swivel bracket 332 which in turn pivots about pin 334. One of the sides of swivel bracket 332 includes a leg 336 which is disposed remote from the area of contact of the swivel bracket by plunger 328. Leg 336 is inserted through flap actuator 338. [Flap actuator 338 serves the combined function of flap holder 266 and puller arm 268 as previously described]. Flap actuator 338 is in the form of a flat plate, as best shown in Fig. 11, which includes an extension 340 disposed against flap holder 318 adjacent latch stop 310 for engaging the frontal face of flap 318. The end face 342 of flap actuator 338 is disposed for either resting upon latch stop 310 when the arrangement is in the locking condition shown for example in Fig. 28 or for abutting against latch stop 310 when the arrangement is in the unlocked condition shown in Fig. 31. Flap actuator 338 is guided in its reciprocal movement through a slot 344 in a wall of channel shaped guide bracket 346. Flap actuator 338 is urged toward contact with the flap by means of spring 348 reacting between flap actuator 338 and guide bracket 346. As with the previously described locking arrangement the guide bracket also provides a stationary member against which leaf spring 324 may react.

As illustrated in Figs. 30—31 upon energization of solenoid 336 swivel bracket 322 is pivoted and its motion is transmitted to flap actuator 338 to pull the actuator in a rearward direction. Because of offset or extension 340, flap 318 is also pivoted away from strike plate 304 whereby the strike plate is in a condition to be unlocked. While in this condition end face 342 of flap actuator 338 abuts against latch stop 310 thus preventing flap 318 from returning to its locked condition. The components remain in this locked condition until the user pushes against the door whereby strike latch 304 is pivoted along with latch stop 310. The pivoting movement of latch stop 310 moves the latch stop from abutment against the end face 342 whereby flap 318, under the influence of spring 324, is moved in a forward direction and carries the flap actuator 338 along with it by virtue of its abutment against offset 340. Thus flap 318 is automatically returned to its locking condition. Strike plate 304 then also returns to its locking condition by the urging of its spring 306. Upon this return movement latch stop 310 is also returned to its original condition.

As with the prior arrangement the various components are mounted in housing 300 by means of a removable cover. Solenoid 326 is removably mounted to the housing by the inclusion of a threaded portion 350 at the end of solenoid which threadably engages nut 352. It is to be understood that any suitable detachable mounting means may be used with either of the arrangements.

The interior door handle 290 is preferably rotatable to permit the user to move bolt 222 away from strike latch 228 thus permitting the user to leave his room without inserting a key in the keyport. Outer handle 230, however, is not rotatable so that a key would be required to enter the room.

WHAT WE CLAIM IS:—

1. A security system for controlling entrance to an area including a lockable barrier at the entrance to the area, an area keyport, actuating means between said area keyport and said lockable barrier, a master console disposed remote from said area keyport, said master console having a plurality of individual master keyports, a coded key for insertion into said area and master keyports, scanning means between said area keyport and said master console for cyclically scanning said keyports and initiating said actuating means for inactivating said lockable barrier to permit entrance to the area when said area keyport and one of said master keyports have identical coded keys inserted therein.

2. A system as set forth in claim 1 wherein said master console is capable of simultaneously having coded keys in a number of its keyports and said area keyport is capable of having only a single coded key therein at one time, and said area keyport key having identical coded data with respect to one of the master console keys.

3. A system as set forth in claim 1 or claim 2 including an alarm actuated by said scanning means when an object is inserted in said area keyport which does not match one of the coded keys in said master keyport.

4. A system as set forth in claim 1, 2 or 3 wherein said scanning means includes comparing means and multiplexing means.

5. A system as set forth in any preceding claim including stimulus sensing means at said area, and stimulus indicating means on said master console for indicating predetermined conditions sensed by said stimulus sensing means.

6. A system as set forth in any preceding claim wherein there are a plurality of said areas, one of said area keyports being provided for each area, and said master console including a series of console guest keyports plus console master keyports for each area keyport.

7. A system as set forth in any preceding claim wherein each keyport includes a housing, a slot in said housing, a plurality of pairs

of electrically conductive spring fingers urged toward each other for making electrical contact, each coded key being an insulating card sized to fit into said slot and between the fingers of said pairs of spring fingers, and said card having a pattern of holes therethrough to permit a corresponding arrangement of spring fingers to contact each other through said holes while the remaining spring fingers are insulated from each other.

8. A system as set forth in claim 7 wherein each card is made of a disposable material, said holes being randomly arranger in accordance with a pattern created by a random noise generator.

9. A system as set forth in any preceding claim wherein said lockable barrier is a door, a lock on said door, said lock including a latch bolt and a night latch, a door jamb, a housing in said door jamb, a strike plate over said housing disposed in the path of movement of said bolt and said night latch, an opening in said strike plate for permitting both said bolt and said night latch to enter said housing, said bolt and said night latch being interconnected whereby said door may be opened when said night latch is extended and said door is locked when said night latch is retracted, locking means in said housing for maintaining said night latch retracted, and unlocking means in said housing responsive to said comparison means for inactivating said locking means to permit said night latch to be extended.

10. A system as set forth in claim 9 wherein said locking means comprises a latch plate abutting against said night latch, said latch plate having a shoulder, a locking lever engaged with said shoulder for holding said plate against said night latch, and said unlocking means being an electromagnet for moving said lever away from said shoulder.

11. A system as set forth in claim 10 wherein an angle-shaped member is disposed between said lever and said electromagnet for controlling the position of said lever.

12. A system as set forth in claim 10 including inactivating means for mechanically removing said latch plate from against said night latch.

13. A system as set forth in any one of claims 1 to 6 wherein each keyport includes a housing, a slot in said housing, a plurality of insulated finger-like protrusions in said housing adjacent said slot, and each coded key being a card for causing electrical contact to be made by a random arrangement of said protrusions upon insertion of said card into said slot.

14. A system according to claim 1 including an arrangement for making coded cards comprising a plurality of extendable actuating members, a corresponding plurality of cams, a corresponding number of punches under said cams and spaced therefrom by a distance such that each cam causes its punch to be driven downward when its extendable member is therebteween and permits said punch to remain stationary when its extendable members retracted, a card support under said punches for causing said card to become perforated when said punches are driven downward, and random selection means for causing a random arrangement of said extendable members to be extended.

15. A system as set forth in claim 14 wherein said extendable members are solenoids, said random selection means including a random noise generator and a binary counter associated therewith for arbitrarily causing a random arrangement of said solenoids to be extended.

16. A system according to claim 1, wherein the locked barrier is a door, including an electronic locking arrangement for operation with the door which has a latch bolt projecting outwardly from the door, the latch bolt having a flat shoulder and a ramp surface, said arrangement comprising a strike latch to be disposed in the door jamb for the door, said strike latch having a flat shoulder for engagement with the bolt shoulder when the door is in its locked condition and a camming surface for riding against the bolt ramp surface when the door is returning to its locked condition, a pivot for said strike latch, a stop for inactivating said pivot, a mechanical puller for disengaging said stop to permit said strike latch to pivot whereby said door may be pushed open, and electronic actuating means for said puller.

17. A system as set forth in claim 16 wherein said stop includes a pivotable flap having a frontal surface disposed toward said strike latch, said puller including a flap actuating means having an offset portion at said frontal surface of said flap, and motion transmitting means for moving said flap actuating means in a direction away from said strike latch to cause said flap to move to an unlocking position.

18. A system as set forth in claim 17 including resilient means urging said flap in its locking position to automatically return said flap to its locking position upon the opening of the door.

19. A system as set forth in claim 18 wherein said stop further includes a first latch stop mounted for pivotal movement with strike latch, said flap in its locking position being disposed in the path of motion of said latch stop to prevent pivotal movement of said latch stop and of said strike latch, said flap in its unlocking position being disposed out of the path of movement of said latch stop, said flap actuating means further including a puller arm and a flap holder disposed adjacent said puller arm, and said flap holder being disposed for abutting against said latch stop when said flap is in its un-

locking position to maintain said flap in its unlocking position until said latch and said latch stop have been pivoted during the opening of the door.

20. A system as set forth in claim 19 wherein said motion transmitting means comprises a swivel bracket, one end of said swivel bracket engaging both said puller and said flap holder to cause joint movement of both said puller and flap holder upon the application of force to the other end of said swivel bracket.

21. A system as set forth in claim 18 including a guide bracket, said guide bracket having guide surfaces for maintaining said flap actuating means in its proper position during its movement thereof, and said resilient means reacting between said flap and said guide bracket.

22. A system as set forth in claim 20 wherein said electronic actuating means includes a solenoid having a plunger disposed for moving against said other end of said swivel bracket upon energization of said solenoid.

23. A system as set forth in claim 22 wherein said flap has a shoulder, said latch stop having an undercut for resting on said flap shoulder in its locking position, said latch stop having a shoulder at its upper edge above said undercut, said stop having an end face between its shoulder and said undercut, said flap holder being disposed for resting on said latch stop shoulder when said flap is in its locking position, said flap holder being disposed for abutting against said end face when said flap is in its unlocking position and before the door has been opened to prevent said flap from returning to its locking position, and resilient means reacting against said flap holder.

24. A system as set forth in claim 16 including an internal handle on said door connected to said latch bolt, and said internal handle being movable to retract said latch bolt away from said strike latch and permit said door to be opened while said strike latch is in its locking position.

25. A method of controlling admittance to an area having a locked barrier comprising inserting a coded card into a keyport in a master console having a plurality of such keyports, sequentially feeding data from the keyports of the master console to a comparator during individual time phases, comparing the data from each phase with data fed from an area keyport adjacent the locked barrier, and inactivating the locked barrier when there is matching data fed from the area keyport by insertion of a coded card identical to the card in the master console keyport.

26. A method as set forth in claim 25 wherein the identical coded cards are made by punching a random pattern or holes simultaneously in the cards in accordance with the noise generated by a random noise generator.

27. A method as set forth in claim 26 wherein the holes are punched by having the random noise generator cause a random arrangement of solenoids to be extended between rotatable cams and punches with the cards being under the punches, and rotating the cams to force the solenoids against the punches for driving the punches through the cards.

28. A security system substantially as hereinbefore described with reference to, and as illustrated in, any of the embodiments illustrated in the accompanying drawings.

29. A method of controlling admittance to an area having a locked barrier, substantially as hereinbefore described with reference to any of the embodiments illustrated in the accompanying drawings.

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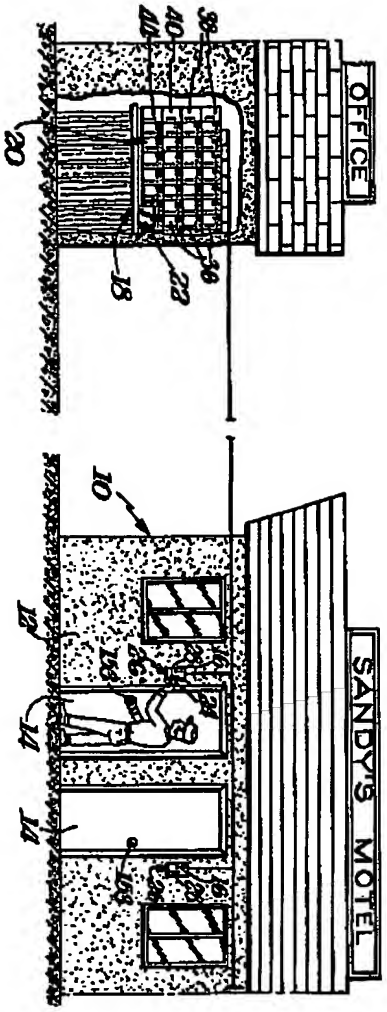

Fig.1.

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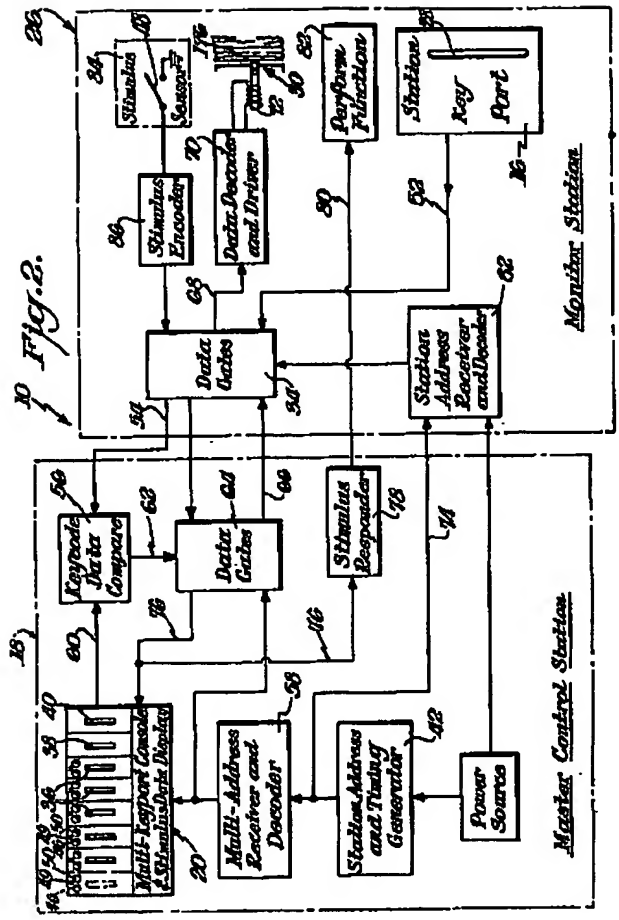

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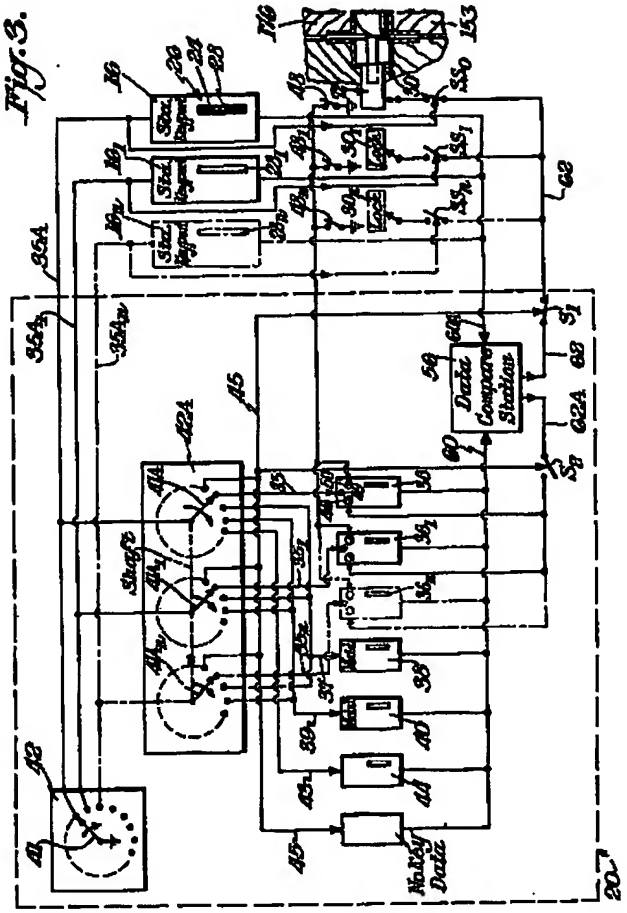
Fig. 3.



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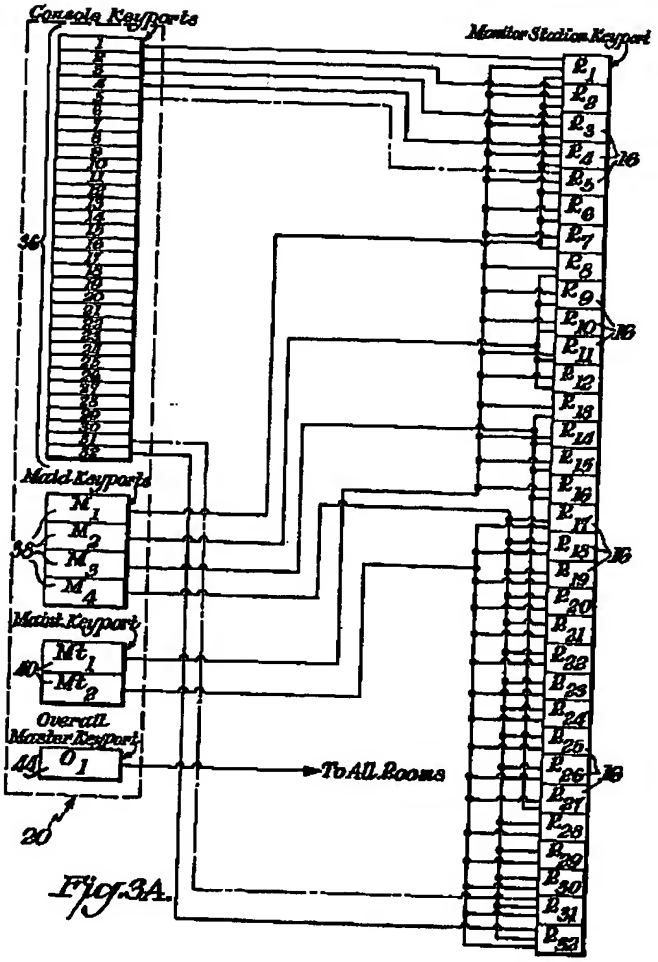


Fig. 3A.

Fig.8.

Fig. 7.

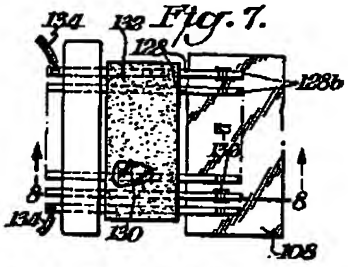


Fig.12.

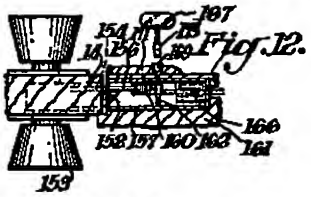


Fig.13.

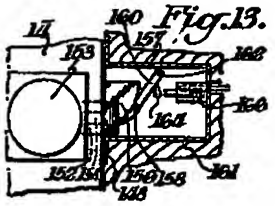


Fig.14.

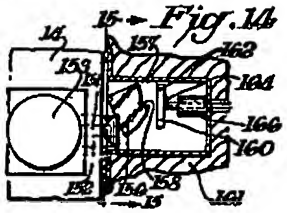


Fig.9a.

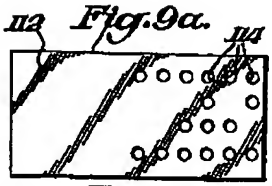


Fig.9b.

Fig.9c.

Fig.9d.

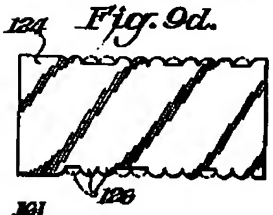
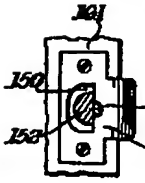


Fig.15.



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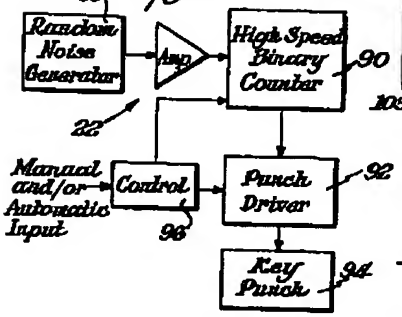

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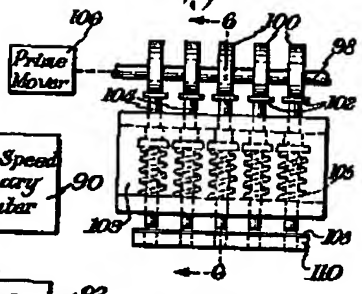

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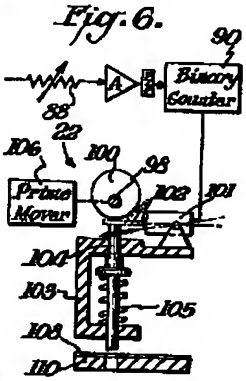
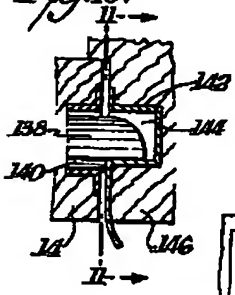


Fig. 10.



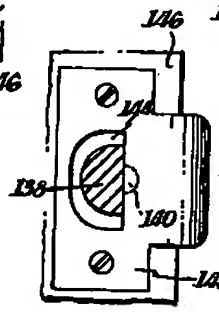


Fig. 11.

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Fig.16.

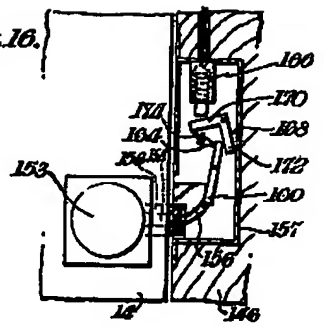

Fig.17.

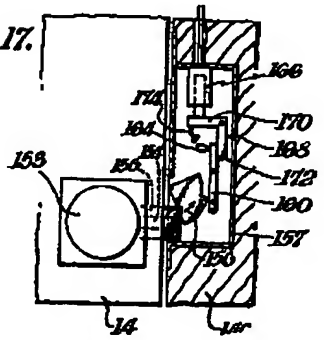

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Fig.18

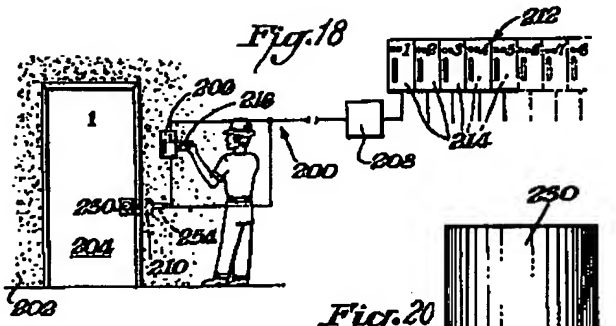


Fig.20

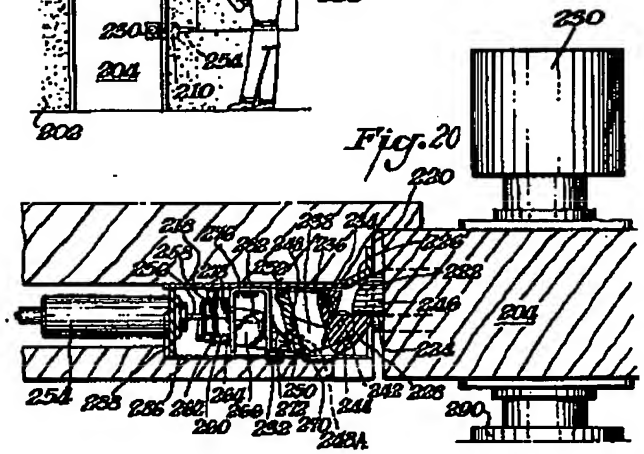


Fig.19

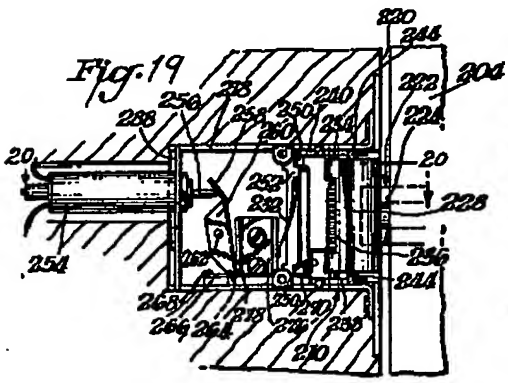


Fig.21

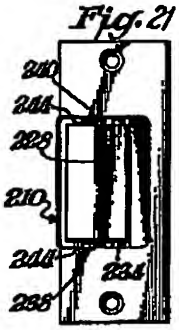


Fig. 23

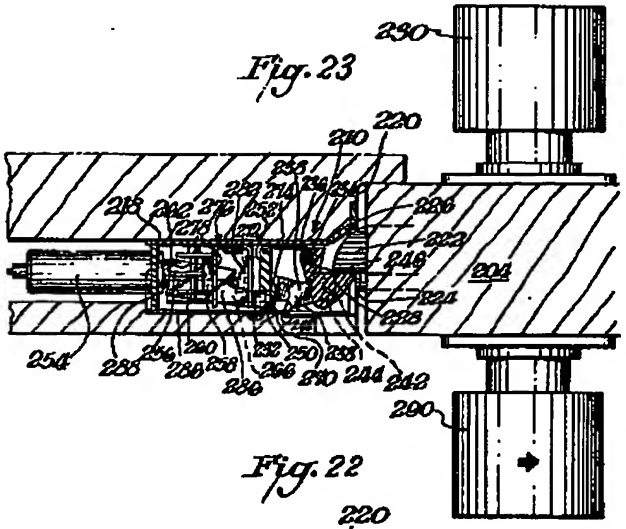


Fig. 22

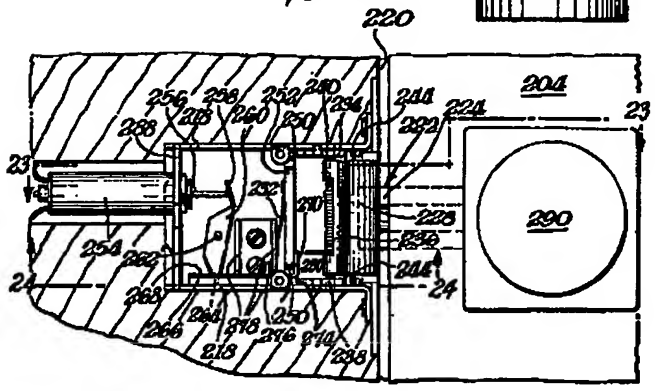


Fig. 24.

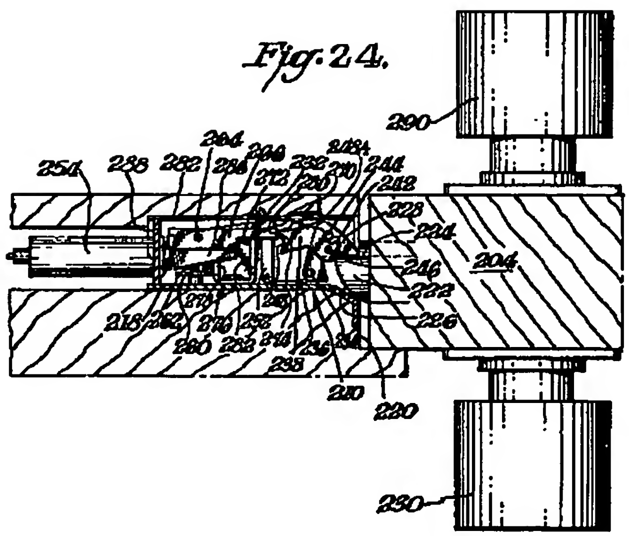


Fig. 25.

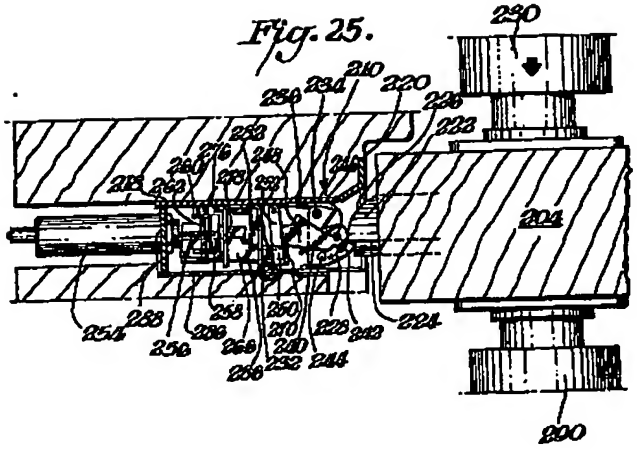
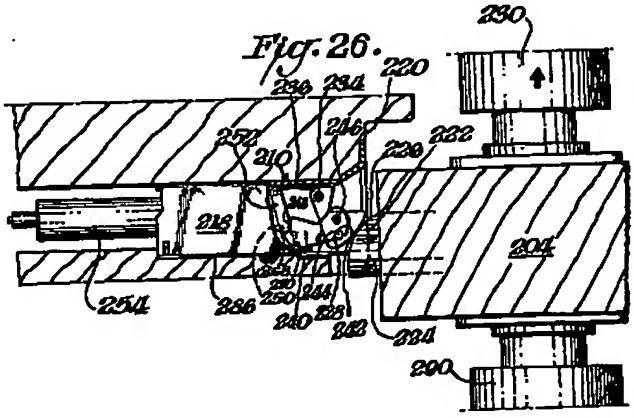


Fig. 26.



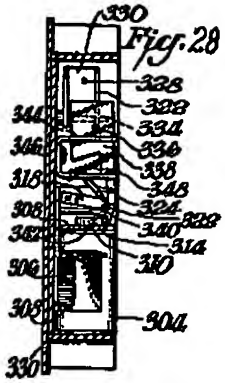


Fig. 28

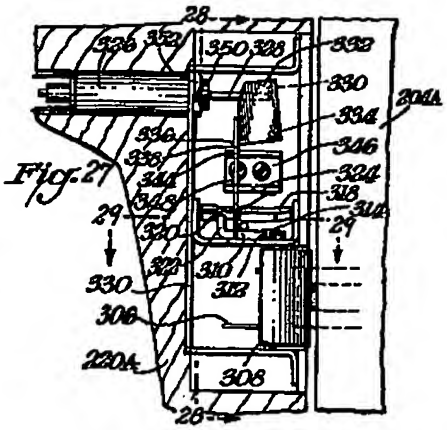


Fig. 27

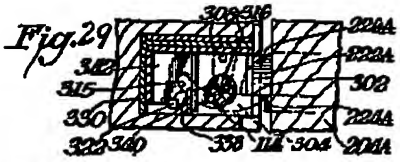
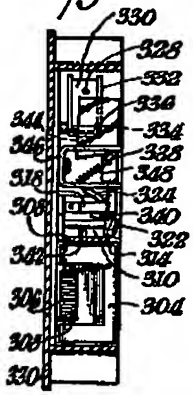


Fig. 29

Fig. 31



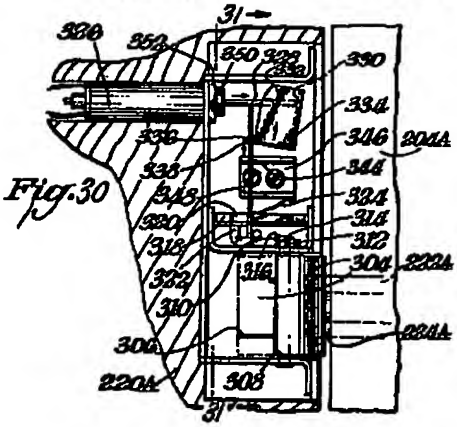


Fig. 30

Fig. 33

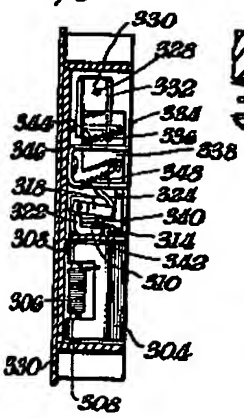


Fig. 32

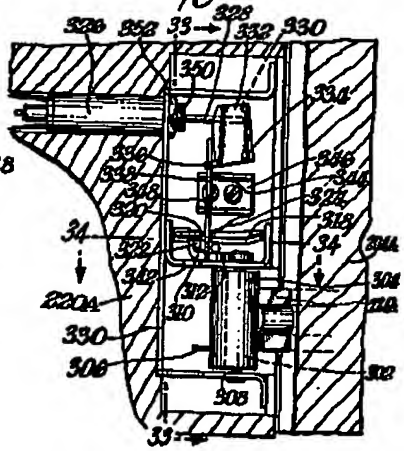


Fig. 34